XVII.—*On* Proteleia * Sollasi, *a new Genus and Species of Monaxonid Sponges allied to* Polymastia.

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[Plate V.]

Amongst the many new and interesting Monaxonid sponges obtained by the 'Challenger' there is one which, while closely agreeing in most respects with the Suberitid genus *Polymastia*, is distinctly marked off from all species of that genus by the possession of a very remarkable spicule, which, both in form and position, strongly calls to mind the characteristic "grapnel" of the Tetractinellida.

Through the kindness of Mr. Murray, Director of the 'Challenger' Commission, we have been enabled to publish in this place a short account of this interesting sponge, whose well-marked characters entitle it to form the type of a new genus. As the chief points of interest concern its spiculation and its relation to other forms as thereby indicated, we shall not attempt here any histological description of the soft parts, reserving any remarks which may be required on that head for our forthcoming Report on the 'Challenger' Monaxonida.

Although it is always more or less hazardous to base a generic diagnosis on a single species, yet the convenience of such a diagnosis is so great that it is preferable to give one, on the understanding that it may be subject to alteration when more species are discovered.

Genus Proteleia.

Sponge sessile, corticate; upper surface covered with mammiform processes; skeleton-spicules spinulate and (or) acuate, and also a spicule with a grapnel-like apex projecting freely beyond the surface of the sponge. No flesh-spicules.

The genus undoubtedly belongs to the family Suberitidæ.

* *προτέλεια*, a beginning; so called because it possesses the rudiment of a grapnel-spicule.

Description of Species.

Proteleia Sollasi.

Sponge sessile, apparently coating (it has been torn off from its attachment), consisting of a flattened cake-like expansion with slightly convex upper surface, from which arise abruptly numerous short, thick, cylindrical, mammiform projections of various sizes. The single specimen in the collection is about 2½ inches long by 1¼ broad and not quite half an inch thick; the mammiform processes vary somewhat in size, being when full-grown about ⅓ inch long by ⅙ inch in diameter at the base; these processes are almost solid and very stiff and firm, contrasting strongly with those of such forms as *Polymastia robusta* and *P. mamillaris* in this respect; at present they are all closed at the summit, and it is doubtful whether any opening exists in the living sponge, though what appear to be traces of such can be found. Colour in spirit yellowish grey. Texture tough and leathery, internally coarsely fibrous; the cortex is very firmly adherent to the underlying tissues. Surface between and on the mammiform processes even, seen in sections to be minutely hispid; hispidity more strongly marked over the body, where also there is a considerable amount of foreign matter collected, than on the mammiform projections, which are almost glabrous in appearance. Vents (? minute, at summits of papillæ). Pores scattered (? singly) over the surface of the body and of the mammiform projections.

Skeleton: (a) *Of the main Body.*—(1) A thin, very dense, and compact external layer (Pl. V. fig. 1, *b*), about ·15 millim. thick, composed of vertically-placed, tightly-packed, small, straight, and slender spinulate spicules, with their apices directed outwards and projecting for a short distance beyond the surface of the sponge. (2) Immediately below the above and inseparable from it a similar but very much thicker layer of larger, stout, spinulate spicules, arranged as in the first layer, and with their apices imbedded in it (Pl. V. fig. 1, *c*); thickness about ·35 millim. These two layers together may be regarded as the cortex. Besides the spinulate spicules already mentioned there are, in the cortex, spicules of another and very remarkable kind—the grapnel-spicules, to be described later. These have the base and a portion of the shaft imbedded in the cortex, while the remainder of the spicule projects freely for a considerable distance beyond the surface of the sponge, and bears at its extremity the grapnel. Immediately below the cortex, as above defined, comes a layer, about as thick as the second cortical layer, of still larger,

stout, spinulate spicules, not vertically disposed, but for the most part horizontally and irregularly, forming a compact mass. Below this layer comes the general parenchyma of the sponge, enclosing very numerous, scattered, spinulate spicules and very well-defined stout fibres, composed of large acuate or subspinulate spicules longitudinally placed, and with their apices outwardly directed. These primary fibres run vertically towards the surface of the sponge; before arriving there they expand into divergent brushes of large spicules, whose apices penetrate right into, or even through, the cortex. Secondary skeleton-fibres, if present at all, are very ill-defined.

(b) *Of the Mammiform Processes.*—The cortex and the layer immediately below it are arranged very much as in the main body, except with regard to the grapnel-spicules, which seem to be entirely absent; then come very definite, stout, longitudinally-placed bundles of spiculo-fibre (Pl. V. fig. 2, *a*), arranged mainly and fairly regularly in two concentric circles, and with the spaces between them filled with a great number of irregularly but closely-arranged spinulate spicules; in the centre of the inner circle of fibre-bundles is a space almost quite free from spicules and filled with a yellow granular substance. The fibres are like those of the main body.

Skeleton-spicules.—(1) Small, slender, very slightly curved, sharply and gradually pointed spinulate spicules with not very well-developed oval heads (Pl. V. figs. 5, 5 *a*); size about ·157 by ·0045 millim.; these spicules occur in the outermost layer of the cortex. (2) Much larger, very stout, sharply pointed, fusiform spinulates, with roundish heads; size variable, about ·22 by ·019 millim.; in the lower cortical layer, passing gradually by spicules intermediate in form and size into (3) the long acuates of the fibres (Pl. V. fig. 3); these are smooth, straight, fusiform, and sharply and gradually pointed at the apex; size about 1·2 by ·03 millim. (4) The grapnel-spicules (Pl. V. fig. 1, *d*, and figs. 6, 6 *a*, 6 *b*); small, long, very slender, with more or less expanded base, and tapering very gradually to hair-like fineness towards the apex, ending finally in a small knob provided with recurved teeth. The teeth seem to be not quite constant in number; commonly there are three or four, but it is extremely difficult to say which, owing to the minute size of the spicule; sometimes the teeth are absent, leaving only the knob (Pl. V. fig. 6 *a*). Length of spicule about ·52 millim., thickness at thickest part of shaft about ·0063 millim. Often the axial canal of the spicule is much inflated in the terminal knob, and occasionally it presents traces of branches towards the teeth.

There are no flesh-spicules of any kind.

Locality. Simon's Bay, Cape of Good Hope, 10–20 fathoms.

As already stated, the relations of this sponge are undoubtedly with the Suberitidæ, yet it is quite distinct from all previously known species, and we create for it a new genus, which we place near to *Polymastia*. Probably Prof. Sollas's species *Radiella schœnus* (=*Polymastia capitata*, Vosm.), to be mentioned later, comes very close to it.

By far the most interesting feature in this new sponge is the remarkable grapnel-spicule and its bearing upon questions of classification, more especially upon the relations of the Monaxonida to the Tetractinellida. The upshot of this is that the sponge in question adds a new and very important link to the chain of evidence in favour of supposing the Tetractinellida to be derived from the Monaxonida. The present occasion seems to be a favourable opportunity for summarizing the evidence which has now been accumulated in favour of this view. Professor Sollas has very kindly favoured us with his views on the subject, which have been indicated from time to time in his various papers. One of the most important links is to be found in the genus *Tetilla**:—

"*Tetilla* is a genuine though somewhat divergent member of the corticate Choristidæ, with close affinities to the Desmacidina; it links together the suborders Tetractinellida and Monaxinellida. The evidence for this statement is found first in its embryological development, next in the characters of the Esperiad *Rhaphidotheca Marshall-Halli*, Kent. In the embryo we find some of its tetractinellid spicules in course of development; they commence with a swelling at the distal end of large uniaxial spicules, from which afterwards teeth are budded off one by one. This is true both for the grapnel- and fork-shaped spicules. Thus the uniaxial clearly precedes the tetractinellid form in development, a fact of signal importance in the discussion as to which originated first, Monaxinellida or Tetractinellida, and in complete correspondence with observations made on the order of development of the spicules in the Calcispongiæ.

"In the next place, in *Rhaphidotheca Marshall-Halli* we find the distal ends of some of the large spicules which project from the skeletal fibres beyond the skin distinctly thickened into globular or oval or cylindrical bulbs, in which the axial thread ends in a slight spherical expansion. . . . . The rounded swelling of the distal ends of projecting spicules is not confined to *Rhaphidotheca*; I have it in a less marked form in a suberite to which I give the name of *Radiella schœnus* (σχοῖνος, a bulrush)."

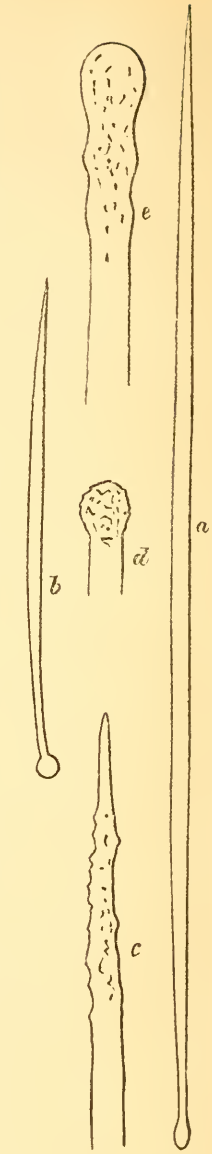
Professor Sollas has kindly sent us preparations and

* *Vide* Sollas, Ann. & Mag. Nat. Hist. March 1882, p. 162.

tracings of the spicule in *Radiella schœnus* (*vide* annexed woodcut). The ends of the chief spicule, which project beyond the surface, are swollen, granulated, and minutely spined. He says (*loc. cit.* p. 163):—"The swollen terminations of the spicules of *R. schœnus* suggest the possibility of a polyphyletic origin for the Tetractinellida."

It is important to notice that, as mentioned by Sollas, it is the projecting ends of the *main* skeleton-spicules, and not of the small cortical spicules, which in *Polymastia* (*Radiella*) *schœnus* become swollen; while in *Proteleia Sollasi* the ends of the small cortical spicule become modified.

Evidence of very much the same kind as to the mode of origin of the tetractinellid spicules is afforded by the Tetractinellid sponge *Thenea Wallichii*, P. Wright*:—"The slender spicules of the anchoring-fibres, over which the ectoderm extends, are mostly rounded at the distal end, like many of the spicules of *R. schœnus*, or the forms which so frequently occur as varieties amongst the pin-shaped acuates. These represent the first stage of the grapnel-spicules, which thus differ from the similar spicules in *Tetilla* by the absence of an initiatory inflation. In the next stage these spicules exhibit near the distal end a number of little tubercular excrescences, similar to those which occur as abnormal thickenings on many of the spicules both of the Monaxonidæ and the Tetractinellidæ. In many cases these tubercles take the form of small teeth, often recurved, and varying in number from one to six. They are seldom situated at the extreme end of the spicule, usually a little distance from it. In the larger specimens we find a considerable advance in growth and development; the spicules show a marked increase in size; and



Radiella schœnus, Sollas: *a*, chief spicule; *b*, spicule of cortex; *c*, *d*, *e*, ends of the chief spicules which project beyond the surface and are swollen, granulated, and minutely spined.

* *Vide* Sollas, Ann. & Mag. Nat. Hist. June 1882, p. 450, pl. xvii. figs. 33–42.

though some of these larger forms still present a merely rounded end, others possess in addition from one to three short conical teeth budded off at some little distance before the end. There is still not the slightest trace of any terminal inflation, such as occurs in *Tetilla*-grapnels. The rays arise merely as spines, precisely similar at this stage to the more numerous spines which cover the distal end of the quadriradiate spicules of *Tricentrium muricatum*. We may indeed, on the basis of these observations, regard the rays of these grapnels as highly developed spines, which, at their inception indefinite in number, become subsequently limited to three."

Leaving now the embryological evidence, which clearly demonstrates that the tetractinellid spicule is derived from the monaxonid form, we must turn to the evidence afforded by several species usually recognized as Monaxonid sponges. First of all it must be observed that the actual number of rays to the spicules in Tetractinellid sponges is by no means constant. Prof. Sollas has very kindly supplied us with information on this point: he tells us, "the variability in number of the teeth is a matter of no moment, so long as they do not frequently *exceed* three. Most *Tetillas* exhibit extreme variability in this respect, the same sponge frequently presenting forks or anchors with one, two, or three teeth."

We have already referred to the evidence afforded by the Suberitid sponge *Polymastia* (*Radiella*) *schœnus*.

Of other Monaxonid sponges with polyaxial skeleton-spicules the genus *Acarnus* forms a very good example. Both the known species of this genus possess grapnel-spicules echinating the skeleton-fibre in tufts. Each spicule has a rounded base attached to the skeleton-fibre, a straight smooth shaft, and a grapnel-like apex; in the one species the number of teeth in the grapnel is four (*A. innominatus*), and in the other three (*A. ternatus*). It is of great importance to notice the position of the grapnel-spicules in this sponge—that they occur within the body and not, as in the Tetractinellida, mainly radiating from the surface; in the one case there is a radiate arrangement, and in the other there is none; hence, though *Acarnus ternatus* possesses grapnel-spicules whose well-developed teeth are almost constantly three in number, yet, having regard to other features, such as the arrangement of the skeleton, it will be seen to come not nearly so close to the Tetractinellida as does *Proteleia*.

In another very interesting monaxonid sponge obtained by the 'Challenger' and to be described fully in our report, under the name *Thrinacophora funiformis*, there is, amongst other

linear skeleton-spicules, one which has a long, smooth, usually crooked shaft, evenly rounded off at the base, and at the apex branching into several short blunt processes, like the fangs of a human tooth; here, it appears, that we have a polyaxial spicule comparable to the forked spicules of the Tetractinellida, derived from the monaxonid type by furcation of the main axis instead of by the outgrowth of spine-like processes. The central canal appears to branch together with the spicule. The systematic position of this sponge is very doubtful; it forms the type of a new genus which, owing to the presence of trichite sheaves, we have included amongst the Desmacidinidæ; but it has very strongly marked axinellid characters and is far removed from the Suberitidæ.

One of the most interesting and important sponges which bears upon this question is the species described by Prof. Sollas in the 'Annals and Magazine of Natural History' for January 1879 (p. 17), under the name *Plectronella papillosa*, a species which subsequently proved to be identical with *Tricentrium muricatum*, Ehlers. This monaxonid sponge, which the author refers to the family Ectyonidæ, possesses an echinating skeleton-spicule which is normally triradiate and occasionally quadriradiate. "These are true quadriradiate spicules, and thus seem to lead on to the tetractinellid type." Carter * also refers this sponge to the family Ectyonidæ; but Vosmaer † considers it a Tetractinellid.

All this evidence seems to lead to the conclusion that the presence of a tetractinellid spicule is in itself not a sufficient guide as to the systematic position of any given sponge, that it may arise independently in different groups of sponges, and that the Tetractinellida are by no means so far removed from the Monaxonida as is generally supposed; indeed, Prof. Sollas tells us that he began to doubt long ago how far the Tetractinellida form a natural group. There seems now to be no doubt that they are derived from monaxonid forms, but whether they have originated polyphyletically or not is another question; so far as spiculation is concerned they may very well have done so; but this is not the place for a discussion of this question. The new sponge which we have here described forms a very important link in the chain of evidence, and as such seemed to be deserving of special notice.

In conclusion we take this opportunity of thanking Prof. Sollas for the invaluable assistance which he has given us in compiling this short account.

* Ann. & Mag. Nat. Hist. ser. 5, vol. iii. p. 293, pl. xxvii. fig. 13.
† Bronn's 'Klass. u. Ordnung. des Thierreichs, *Porifera*,' p. 322.

EXPLANATION OF PLATE V.

Proteleia Sollasi.

Fig. 1. Vertical section through surface. ×44. *a, a*, primary skeleton-fibres; *b*, outer layer of cortex; *c*, inner layer of cortex; *d*, grapnel-spicules; *e*, accumulation of foreign matter on the surface.

Fig. 2. Transverse section of mammiform process. ×12. *a*, sections of skeleton-fibres; *b*, outer layer of cortex; *c*, inner layer of cortex.

Fig. 3. Large acuate skeleton-spicule. ×120.

Fig. 3 *a*. Smaller acuate skeleton-spicule. ×190.

Figs. 4, 4 *a*. Large, stout, spinulate skeleton-spicules. ×190.

Figs. 5, 5 *a*. Small, slender skeleton-spicules. ×190.

Fig. 6. Grapnel-spicule. ×190.

Fig. 6 *a*. Grapnel-spicule, with terminal expansion, but no teeth. ×190.

Fig. 6 *b*. End of one of the grapnel-spicules. ×500.

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The Crocodilian fauna of the Siwalik rocks is closely allied to the existing Indian types, but is remarkable for the great development of Gharials, two of which were animals of larger size than any living representatives of the group. The descriptions commence with a short account of the characters of fossil allies of living crocodiles, which have been described from Tertiary and Cretaceous strata. Three recent Asiatic species of the genus *Crocodilus* are known and two fossil forms are now described. *C. sivalensis* is well known from crania and other remains, extending from the Punjab through the Siwalik hills to Burma. It is closely allied to *C. palustris*, and differs in the greater width of the interorbital bar, in the more backward position of the anterior nares, the rougher sculpturing of the premaxillary bone, and some other characters; but the author observes that the variety of *C. palustris* from Ceylon approximates nearer in some respects to the fossil than to the other Indian forms, and hence the Siwalik species is regarded as the ancestor of its existing ally. It is not without interest that the *C. Hastingsiæ* of the Headon beds closely resembles the crocodiles of the *C. palustris*